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No. 9

March 1, 1919

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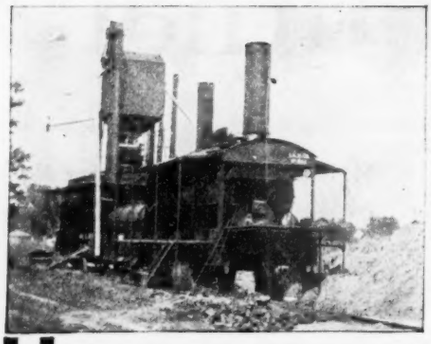

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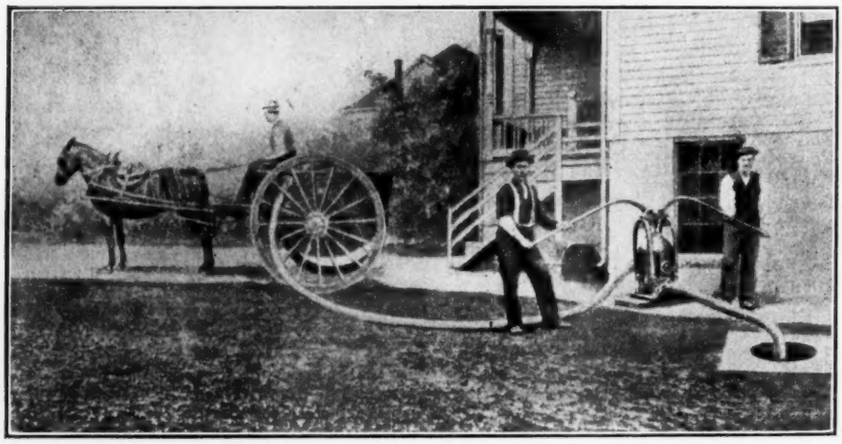

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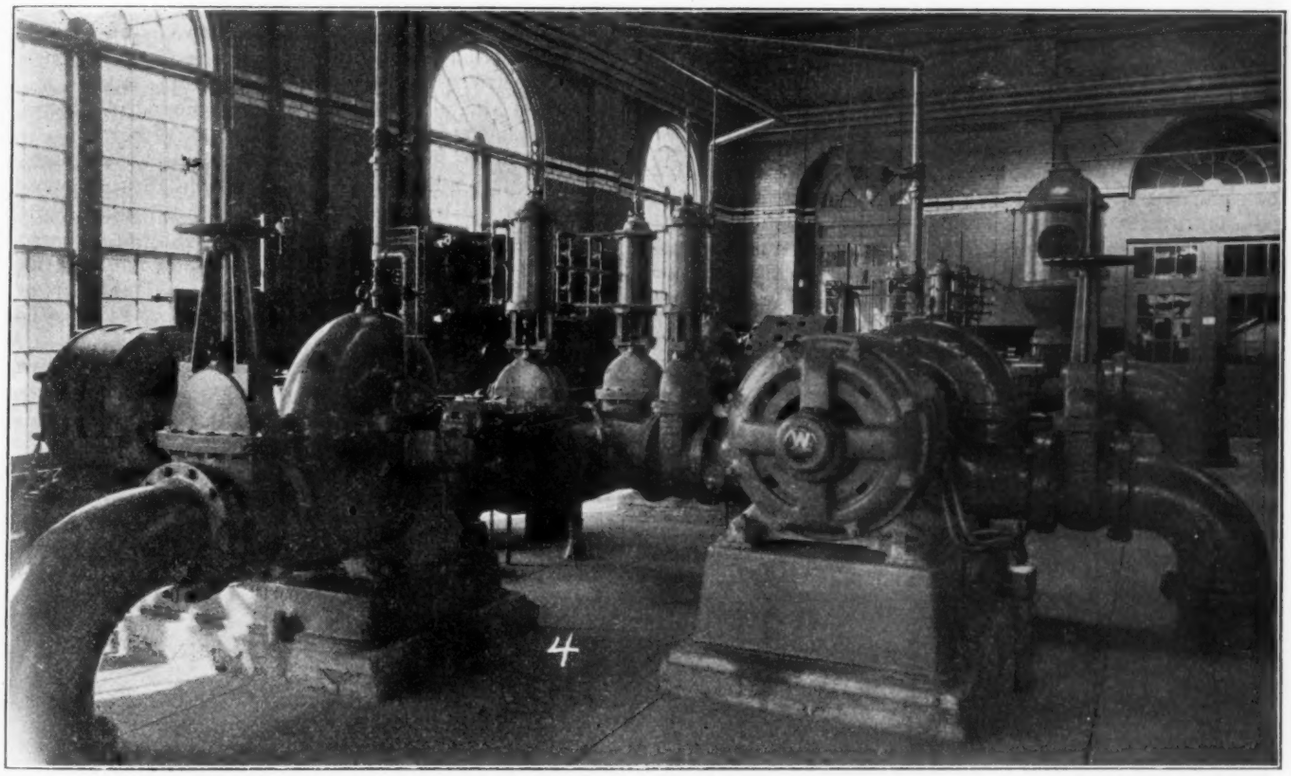
Municipal Journal

Volume XLVI NEW YORK, MARCH 1, 1919 No. 9

LANCASTER'S REMODELED PUMPING PLANT

Changed from a Steam to an Electric Plant—Cost of Operating Plant Reduced One-Third—Details of Pumps, Motors and Other Equipment—Result of Test of Pumps.

By JOHN T. BRAINARD.*



THE THREE LOW-LIFT ELECTRIC PUMPS.

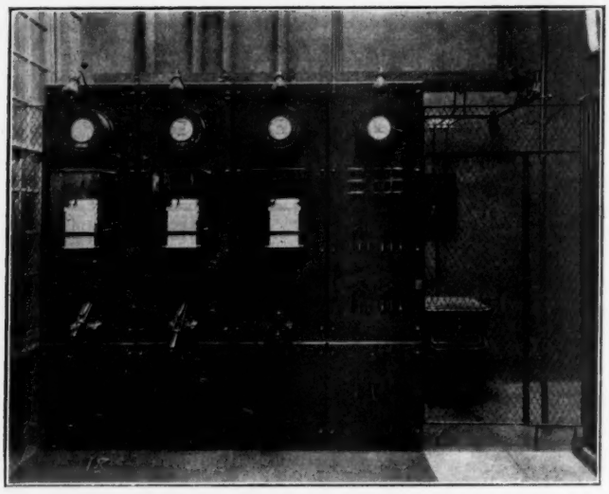
The municipal water plant of Lancaster, Pa., obtains its supply of water from the Conestoga river, which has a watershed of more than three hundred square miles above the city and has a minimum flow of forty million gallons per twenty-four hours. The water is filtered and is pumped into a reservoir, while the high service of the city is supplied from a standpipe. The filtration plant was installed in 1905 and the efficiency of its operation has never fallen below 98 per cent.

Until a little over a year ago the water was pumped by means of one six-million and one ten-million gallon Worthington pump and one twelve-million gallon R. D. Wood of the horizontal type, these three pumps having been built in 1890, 1893 and 1903 respectively. In April, 1915, the people voted $125,000 for converting the pumping plant into an electrically operated one, and for some improvements in the distribution system. Plans for the plant were perfected and the city council awarded contracts on April 1st, 1916, and construction work began in the fall of that year. A considerable part of the work of removing the old pumps and remodeling the building was done by municipal employes under the superintendent of the water department, Charles K. Will, thereby effecting a large saving in the cost to the city.

All of the work was completed within the appropriation and without increasing the city taxes or the water rates. On the other hand, if the city were using steam this year for pumping, an increase in either water rates or taxes would certainly have to be made; but as it is, the water committee has decided not to make any change in the rates for the present, the charge being five cents per thousand gallons.

During 1917, while transition was being made from one system to the other, the cost of neither could be determined with any accuracy. The cost of electric operation during 1918, however, can be compared with steam operation during 1916. The cost of operation during 1918, when 2,686.8 million gallons was pumped by electricity, was $42,821.72, while in 1916, 2,569.37 million gal-

*Secretary of Water Department, Lancaster, Pa.



POLYPHASE WATTHOUR METERS; GRAPHIC METERS.

lons pumped by steam at a cost of $54,903.76. Fourteen men were employed at the plant in 1916, but only eight men in 1918. The receipts for 1918 were $193,265.12 and those for 1916 were $173,942.53. The average pumping so far this year has been at the rate of 7,950,000 gallons per day, the total pumping capacity being 23,000,000 gallons.

The new machinery contracted for comprised five high-duty pumps, three low-duty pumps and two vacuum pumps that were furnished by the Earle Gear and Machine Works, the cost being $60,590; electric motors and other equipment furnished by the Westinghouse Electric & Manufacturing Co. for $32,828; the electric wiring was let to the Lord Electric Co. for $6,233, and the contract for the pipes and special castings to the Standard Cast Iron Pipe and Foundry Co. at 2½ cents and 8 cents per pound respectively.

The high-duty pumps are centrifugal, two-stage, direct-drive, two of 5,000,000 gallons a day capacity, two of 4,000,000 gallons, one of 3,000,000 gallons, giving a combined rated capacity of 21,000,000 gallons. This amount can be considerably exceeded, however, as on several occasions the two 4,000,000 gallon pumps alone have pumped 11,000,000 gallons. These pumps work against an average head of 240 feet.

The three low-duty pumps are centrifugal, single-stage and are used for pumping water from the receiving basin into the filtration plant against a head of approximately 44 feet.

The five-million-gallon high-duty pumps are driven by 300 h.p. motors, the four-million-gallon pumps by 250 h.p. motors and the three-million-gallon pump by a 200 h.p. motor. One of the motors driving the low-duty pumps is 100 h.p. and the other two are 75 h.p. A 10 h.p. motor drives the machinery in the machine shop and two 1 h.p. motors are direct connected to two vacuum pumps that are used for priming the low-duty pumps.

The slip-ring motors for the high-duty pumps are started and controlled by Westinghouse magnetic switch-type automatic controllers, which start by cutting resistance out of the secondary of the motor. Interlocks definitely determine the rate at which the motor is brought up to speed. A four-panel board controls the two large pumps and a six-panel board controlls the four-million-gallon and three-million-gallon pumps.

The low-duty pumps are started by auto-starters or compensators for reducing primary voltage. The vacuum pumps are started by a simple single-throw switch. The master circuits to the control for the high-duty pumps are duplicated in the engineers' quarters and any or all can be started or stopped from either that point or from the main board.

Current for operating the plant is obtained from the Edison Electric Co. and is transmitted from a separate panel at a sub-station by a duplicate three-phase line, which for a considerable part of the way is supported on latticed steel towers and follows a right of way especially chosen because of its freedom from possible interruptions. At the entrance to the waterworks grounds is located an iron frame supporting duplicate sets of electrolytic lightning arresters with their accompanying choke coils, hook switches and horn gaps. After passing through the choke coils, the energy is brought into the transformer room by duplicate lead-encased high-tension cables.

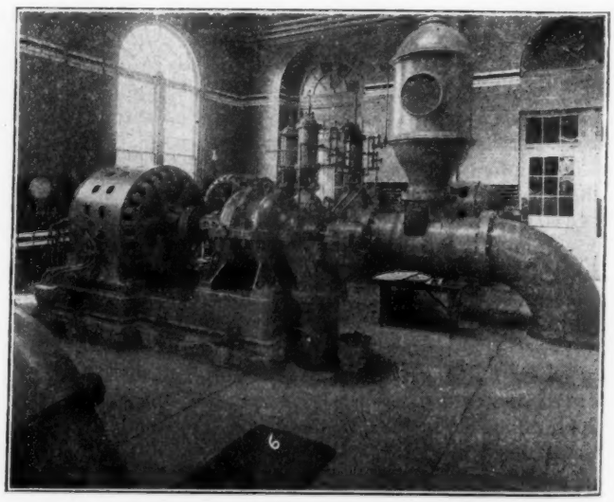
The transformer room contains 400-kva., single-phase transformers, 11,000 volt primary and a combination secondary suitable for 2,300 or 575 volts, the latter being used at present. There is also a 10-kva. transformer from 575 to 230-115 volts for lighting the plant and also a large electric sign containing 570 lamps located on the roof of the plant and containing the words "Lancaster, Pa., Waterworks Pure Filtered Water."

A panel with the necessary meters, circuit breaker, with over-load time-limit relays, controls the high-tension buss to the transformers. A four-panel board controls the three power circuits and the lighting circuits. One panel controls the 300 h.p. pumps and another the remaining three high-lift pumps, while a third serves the low-lift pumps, the machine shops and vacuum pumps.

Of the original steam plant, the 12-million-gallon steam pumps with its boilers and two 10-million turbines are retained for an emergency.

Should the current fail from any cause, connection can be made very quickly with the Baltimore steam plant, or the 12-million-gallon steam pump can be put into service, steam being kept up at ten pounds in the boilers at all times.

Since pumping had to be continued during the change from steam to electric power, it was not possible to dismantle all of the steam plant until a corresponding capacity of electric pumps were ready and connected up for operation. Apparently the only thing to do was to build an addition to the building for the transformer room. After this room was well under way, the 6-million-gallon steam pump was dismantled, this work being



HIGH DUTY PUMPS, TWO OF FIVE MILLION AND ONE OF THREE MILLION GALLONS.

begun on March 19th, 1916, and finished on May 4th of that year. (This left the ten-million and twelve-million pumps to do the work.)

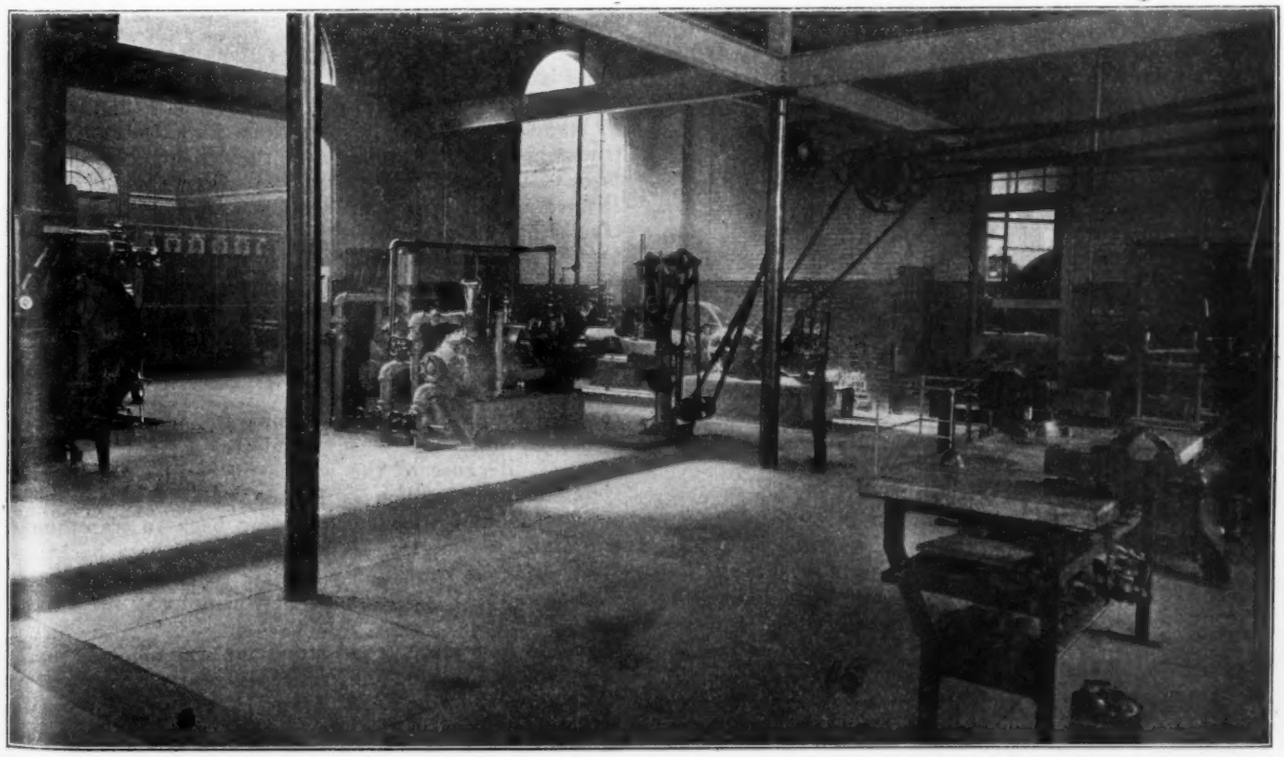
The old 6-million-gallon pump was removed by the employes of this department at a cost of $203.85, and the department realized from this pump a net profit of $559.16, in addition to which they retained for use many valuable gauges and valves. Concrete foundations were then constructed for the two 4-million-gallon electric pumps, and these were set in place. These two 4-million-gallon pumps started continuous operation on January 24, 1917. The pumps were tested by the contractors for the pumps and for the motors and the plant showed high efficiency, together pumping eleven million gallons in 24 hours. Following the completion and testing of these pumps, they were operated continuously, and, relying on their operation, the 10-million-gallon steam pump was dismantled, leaving only the two 4-million-gallon electric pumps and the 12-million-gallon steam pump to supply the city. These pumps were operated alternately, or together when necessary, and as on some days the average pumping exceeded twelve million gallons, the department realized that it was taking a chance, and asked the public to economize in the use of water, especially on Monday mornings when the draught is heaviest. The waterworks' employes completed the dismantling of the 10-million-gallon pump on March 3, 1917, this work having been done by them at a considerable saving to the city.

Following this, the three low-lift electric pumps and the remaining three high-lift pumps were installed and began active service. Since that date all the pumping of the water department has been carried on by the electric plant, and the steam equipment has not been used. It was certainly a relief when the three high-duty electric pumps were all in operation, and superintendent Will, the water committee and the mayor all slept better at night when the risk of a break-down was over. During the entire transfer from steam to electricity there was no interruption to the service.

Final tests were made of both high-duty and low-duty electric pumps on July 1, 1918. One 4-million-gallon pump pumped at a maximum rate of 5.47 million gallons per day and the other at a maximum rate of 5.10 million gallons; the former reaching a maximum efficiency of 77.4% at the maximum rate named while the second reached a maximum efficiency of 77.7% when pumping at its maximum rate. One of the 5-million-gallon pumps developed a maximum efficiency of 74.7% when pumping at the rate of 5.55 million gallons, the other 5-million-gallon pump reaching a maximum efficiency of 72.8% when pumping at the rate of 5.85 million gallons. The 3-million-gallon pump attained a maximum rate of 3.84 million gallons, at which its efficiency was 73.3%. Of the three low-lift pumps, the 7-million-gallon pump developed a maximum efficiency of 85.3% when pumping at the rate of 8.06 million gallons a day; the 6-million-gallon pump reached an efficiency of 87.2% when pumping at the rate of 6.37 million gallons per day; and the 5-million-gallon pump reached its maximum efficiency of 80.8% when pumping at the rate of 5.88 million gallons per day.

In connection with the new pumping plant, a number of improvements in appurtenances have been made. Foxboro recording gauges have been installed; a long-distance electric recording gauge has been installed at the standpipe a mile away, and a general recording system reports every ten minutes the height of water in the standpipe and the reservoir, and records the pressure every minute. A 24-inch Pitot recording meter has been installed to measure the raw water pumped to the filter plant, and since the installation of this meter very little water has been wasted in washing the filter beds. The entire plant is so equipped with meters and recording gauges that every 24 hours a record of the efficiency of operation of each item of the entire plant can be secured.

Many improvements have been made to the pumping station and to the reservoir and grounds, as well as needed improvements throughout the distribution sys-



MACHINE SHOP OF THE WATER DEPARTMENT.

tem. A new concrete storage house was included in the improvement at the waterworks plant. Six thousand feet of 16-inch water pipe was laid across the northern part of the city to supplement the 20-inch main artery on Orange street. As soon as a right-of-way can be obtained from the railroad company, this main will be continued across the tracks and connect with a 24-inch main for the purpose of increasing the pressure in the section just deyond this point. A large concrete building was constructed at the East End reservoir to house a booster pump and electrical equipment used for pumping water from the reservoir into the standpipe in order to keep up the pressure in the high service during a shut-down at the main pumping station.

FREIGHT RATES ON SAND AND GRAVEL.

Representatives of the National Association of Sand and Gravel Producers were in Washington last week endeavoring to persuade the Railroad Administration to reduce freight rates on sand, gravel, crushed stone and slag, and interested the Department of Labor in the matter. They advanced the arguments that this would stimulate public works, giving employment to laborers; provide use for an existing surplus of open-top cars; increase the revenue of the railroads; put idle capital in circulation, and give to contractors and producers of building materials a chance to recuperate some of the losses sustained by the necessary restrictions placed on construction work during the war.

The secretary of the association, E. Guy Sutton, says that there are thousands of open-top cars idle, because of the increased demand for coal, that could be used for hauling sand, gravel and broken stone; but that the rates created by General Order No. 28 are so high as to prevent the movement of these materials.

SOME LESSONS FROM FRENCH ROADS.

Macadam Roads as Built in France More Expensive Than Ours, but Could Not Withstand Our Traffic—Will Probably Fail There Soon.

By E. A. KINGSLEY, Major of Engineers.*

The American Expeditionary Forces have occupied various portions of middle and Southwestern France. It has seemed, at times, that the great Intermediate Section was being colonized by the United States troops. Hundreds of towns and hamlets were so thickly populated with these troops that one would often wonder, almost, whether he were in war-torn France or back in America. The dear old Stars and Stripes was as commonly seen in many communities as the Tri-color. And our flag is as well known to the French child as is his own.

Much in France has amused the 2,000,000 Americans sent over. Many of the customs have seemed strange. But to the alert and observing citizens of the big sister republic many lessons have been taught. The return of the army to the United States will bring new ideas, new thoughts and new customs.

Perhaps the most impressive thing with which every man in the army has been brought in close contact is the condition of French highways. Without these wonderfully built and maintained arteries of traffic, the first Battle of the Marne would have been lost to civilization. And had it not been for the excellent through and connecting roads, the 600 miles of "Lines of Communication" of the American Army could not have existed and the armies at the front in close touch with the Hun Devils would not have been maintained as they were. The realization of these facts has made just as many road boosters, enthusiastic improved-road advocates, as there are men and women in the army and its allied organizations.

In the enthusiasm over the French roads, it is possible that the returning citizens may unknowingly become overzealous. There can be no question as to the ability of the French road engineers, the "Ingenieurs des Ponts et Chaussees," in their design and as to their thoroughness in construction. The roads of France, after four years of war traffic, stand as a monument to these engineers and their system. To the American road engineers and the road contractors who have been with the American Expeditionary Force, the ability of these water-bound macadams to withstand the war traffic has been little less than marvelous. Especially is this true of those of us who came with the earlier forces in 1917 and have seen the roads under American traffic from the first until the close of 1918.

The connecting links, great macadamized arteries of traffic, from base ports to the front all passed through the largest of our sectional areas, the Intermediate Section. In consequence, these main roads were subjected to the heaviest of the American Army traffic excepting the concentrated traffic just back of the fighting line. The stretch of about 150 miles from Bourges to Dijon perhaps carried the greatest traffic in Service of Supply. Like most of the great roads of France, this was a macadamized road and may be taken as a model or pattern of the French type. The wearing surface is of as hard material as can be obtained within reasonable limits of expense. In some sections it is porphyry or granite; in others it is a hard blue rock resembling in some degree the blue traps of the United States, but more closely related to the schists. Through a few sections a gravel surface has been built. The predominating material, however, is lime-rock of varying degrees of hardness. Lime-rock is very plentiful in almost any section of Central France, and while much of it is too soft for a wearing surface, it answers well for a base and cheapens materially construction costs. Hard lime-rock is obtained in so many communities that the surfacing material is not expensive.

The terrific traffic these roads have been called upon to stand was almost beyond conception. Hundreds of trucks have moved rapidly over these roads carrying millions of tons of freight. And the word "moved" is used advisedly, for American drivers have seen that their trucks moved and moved rapidly. If the designer of some of the big army trucks in France could see the rate of speed at which the products of his fertile brain were moving freight in France he would start to work on a governor that could not be tampered with.

All of this has had a tendency to cause the average man to scratch his head in wonderment and say: "Why can not we in America, at comparatively small expense per mile, duplicate these wonderful French macadam roads?" Because of the wonderful results obtained by water-bound macadam in France, many men are going to return home to advocate going back to waterbound macadam in America. It literally would be a backward step. America can build macadam roads as good as the French roads, if she will, but it will not pay for a number of reasons.

In the first place, good stone for water-bound macadam is very prevalent in France, in nearly every section. Then, too, the climate of France is damp and moisture is nearly always in the atmosphere. These two conditions that make for good macadam roads in France, do

*Superintendent of Roads, Intermediate Section, American Expeditionary Forces, Nevers, France.

not exist, as a rule, in the United States. Recognizing that moisture is a necessity for the preservation of their roads, the French have planted trees everywhere in rows on each side of their roads. In some places they have planted two rows of trees. The traveler usually thinks, "How nice is this shade this warm day." But the engineer who planted the trees thought, "This will help bind and keep my road."

The cross-section of the French road is peculiar in design. On the extreme edges of the roadway or berm are ditches of sufficient size to care for the drainage. Between ditches, if the metal surface is to be six metres, the entire distance will be twelve meters; if the metal is five meters, then the width between ditches will be ten meters. Between ditches is double the width of the metal surface. But the metal surface is invariably in a trench. Excavation for the rock is made sufficiently deep so that when finished the road surface will be, at the shoulders, approximately ten centimeters (4 inches) lower than the surface of the berm.

American practice is to have the edge of the roadway and the berm at the same level. Most specifications require that in final rolling one wheel of the roller travels on the metal and overlaps on the berm. The French practice is expensive, first, because of additional excavation required. Then, every 20 or 25 metres a cross ditch to the main drainage ditch must be cut. This adds to the construction cost and certainly prevents any possibility, even in emergencies, of using any part of the berm for traffic. Again, the shoulder has a tendency to catch all of the dirt washed from the road's surface in wet weather. In one way this is not a bad scheme, as it prevents the main ditches from filling with this material. In maintenance work, this depressed roadway is more expensive, for the cross ditches must be kept open at all times. The collections of dirt along the shoulders must be taken care of, too, or the drainage scheme fails.

One point never overlooked is the drainage. On so many roads in America, the drainage question, while perhaps not overlooked, has been neglected. Not so with the French engineers. In the first place, the road is located with a view to drainage conditions existing or to be arranged. In the second place, adequate ditches are built and adequate culverts and undercrossings are provided. Then is the road built. And you don't find French roads washed out.

One thing in maintenance that has made for good roads in France has been the abundant and cheap labor. This has made the development of the cantonment system or patrol system of continuous repair possible. Then too, France is a country of short distances and small farms. The United States is just the reverse. France uses the oxcart and the big-wheeled wagon. The American farmer is going to tractors and automobiles. Waterbound macadam roads improve under the rolling of the big wheels of the French carts and wagons. They go to pieces under the rapid traveling of American cars and trucks, even with the favorable climatic conditions. All of these things have tended towards good macadam roads in France. After the war will it be so? Labor will be less plentiful. Thousands of the beautiful protecting trees have gone for war purposes. The automobile and auto truck will come into more general use. The macadam roads will then fail as they have failed in America.

Engineers who have specialized in road work and who know roads and conditions owe it to their country to teach the lessons they have learned in France. Many thousands of men who have seen these roads stand up under our traffic for a year will only be impressed thus far. They do not go deeper because they do not know. It is not an opportunity but a duty which confronts the road engineer. He, who has been in France and has seen, must return to preach and teach: "The day of waterbound macadam for American main highways is passed." The returning forces will be good-roads advocates, but in the enthusiasm for good roads and their praise for French roads, let them not forget that the problem cannot be solved by an off-hand comparison and a consequent conclusion. For American arteries of traffic, her main highways, macadam roads can never be successful roads. They will always be the most wasteful expenditure of public funds. It is now costing America thousands of dollars every day to repair the damage done the French roads during the year 1918. And the end is not in sight. For through roads carrying any considerable traffic, waterbound macadam will not suffice. And waterbound macadam roads are not permanent roads.

COAL CONSUMPTION IN CENTRAL STATIONS

Coal Consumption of 6¼ Tons Per Horse-Power-Year the Minimum—Load Factor More Important Than Size.

Research in the subject of the rate of coal consumption in various electric generating stations in Canada and the United States was conducted in 1917 and 1918 by the Hydro-Electric Power Commission of Ontario, the investigation including 73 stations. No stations were included that used wood, oil or any fuel other than coal for steam generation, nor those employed for standby or auxiliary purposes. Most of the figures are for the years 1912 to 1916 inclusive.

An arbitrary division of the plants was made into six classes as follows:

Class A includes stations up to 1,000 kw. capacity.

Class B includes stations from 1,001 to 5,000 kw. capacity.

Class C includes stations from 5,001 to 10,000 kw. capacity.

Class D includes stations from 10,001 to 50,000 kw. capacity.

Class E includes stations from 50,001 to 100,000 kw. capacity.

Class F includes stations above 10,000 kw. capacity.

There were three stations of class A, averaging 650 kw.; ten of class B, averaging 2,980 kw.; twelve of class C, averaging 7,230 kw.; eight of class D, averaging 24,600 kw.; one of class E, of 96,000 kw.; and one of class F, of 149,000 kw.

The more important items of information secured, averaged for each class are given in the table on the next page.

All of these plans were used for both lighting and power, while railways were operated by one of class A, three of class B, eight of class C, six of class D, and the plants of classes E and F.

Stoking. In class A, all three plants used hand stoking. In class B, three were hand-stoked and seven used mechanical stokers. In class C, one was hand-stoked, two both hand and mechanical, and the remaining nine mechanical only. In classes D, E and F mechanical stoking only was used.

Draft. In class A, all used natural draft. In class B, four used natural and six mechanical draft. In class C,

six used natural, one both natural and mechanical, and five mechanical. In class D, three used natural draft, and five mechanical. The class E plant used both natural and mechanical; and class F, mechanical.

Prime Movers. In class A, one plant used engines, one turbines, and the third used both. In class B, six used turbines only and four used both. In class C, five used turbines only, seven used both. In class D, turbines were used by six, both engines and turbines by two. Turbines only were used by classes E and F.

All the engines but five were condensing, and all the turbines but two.

All the plants operated 24 hours a day.

It appears that the average yearly load factor for Canadian central stations deriving their energy from coal through the medium of steam, is 30 per cent; the rate of coal consumption per h.p. year is 23 tons; the plant capacity is 134,000 h.p. The average rate of coal consumption works out to nearly 32 tons per h.p. year, so that 30 tons per h.p. year will serve very well as a round figure for general estimating purposes and is low rather than high.

For convenience it will be well to give this figure in various forms, thus:

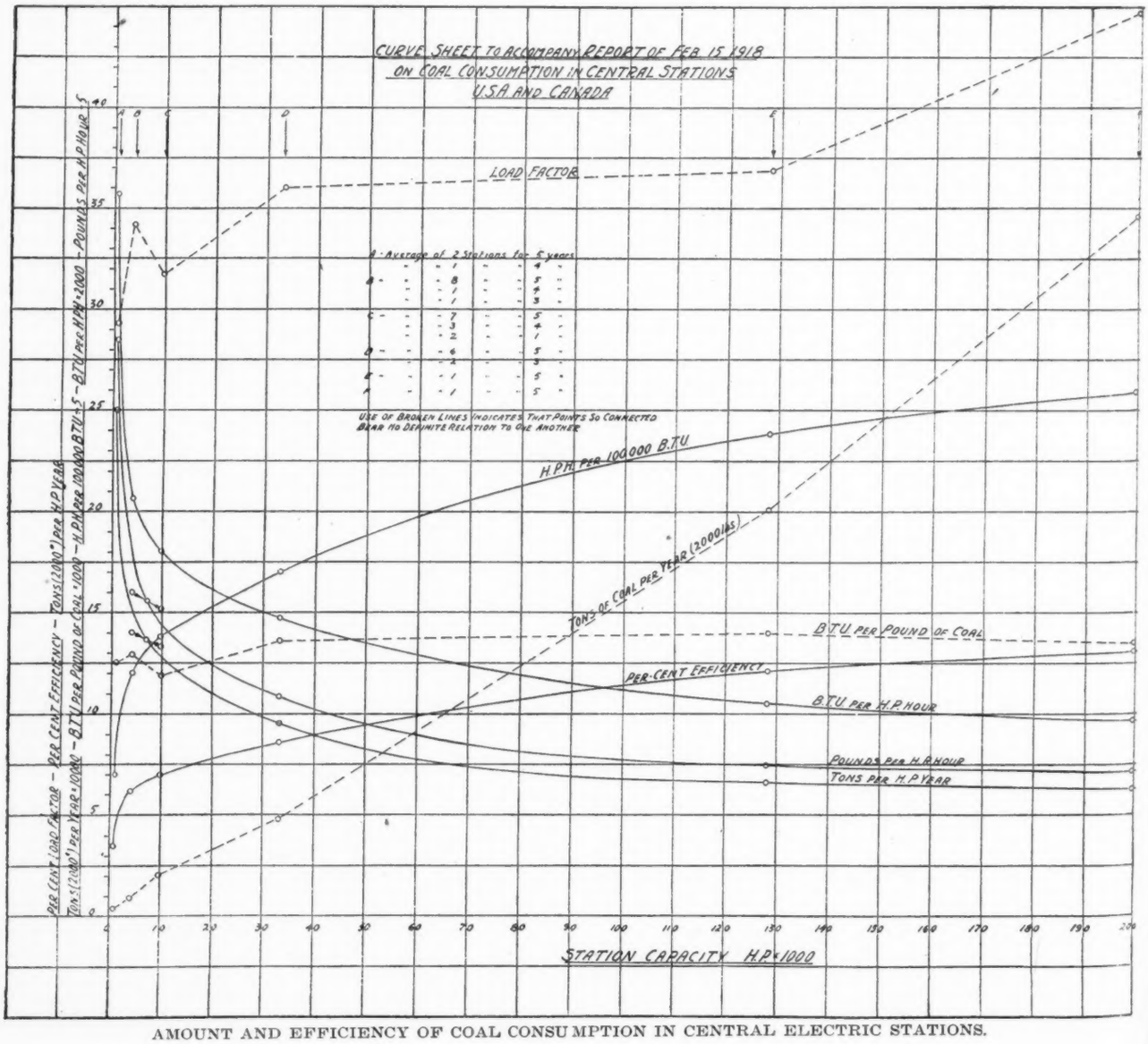
Lbs. per		Tons per	
K.W.H.	H.P.H.	K.W.Y.	H.P.Y.
9.2	6.85	40	30

Summing up certain other figures presented in the report, it appears that, for electric generating stations, using coal fired under boilers, such as are in actual operation in Canada and the United States today, the average

Data Concerning Plants, Averaged by Classes.

Class	Station Capacity K.W.	H.P.	Lbs. per K.W.H.	Lbs. per H.P.H.	Coal Tons per K.W.Y.	Coal Tons per H.P.Y.	B.T.U. per lb.	% Load Factor	% Efficiency*
A	650	870	7.65	5.70	34.60	25.10	12,500	29.3	3.5
B	2,980	4,000	4.30	3.20	19.00	14.00	12,900	34.2	6.2
C	7,230	9,700	4.07	3.04	17.80	13.30	11.900	31.7	7.0
D	24,600	33,000	2.91	2.17	12.75	9.52	13,600	36.0	6.6
E	96,000	128,800	2.01	1.50	8.80	6.57	14,000	36.9	12.1
F	149,000	199,500	1.92	1.43	8.40	6.26	13,500	44.7	13.1
All.... classes	46,340	62,600	3.81	2.84	16.90	12.46	13,600	35.5	8.4

*"Efficiency per cent" is the percentage of the efficiency of conversion of heat energy in the coal to electric energy at the switchboard.


CURVE SHEET TO ACCOMPANY REPORT OF FEB 15 1918
ON COAL CONSUMPTION IN CENTRAL STATIONS
U.S.A AND CANADA
LOAD FACTOR
A: Average of 2 Stations for 5 years
USE OF BROKEN LINES INDICATES THAT POINTS SO CONNECTED BEAR NO DEFINITE RELATION TO ONE ANOTHER
H.P.H. PER 100 000 B.T.U
TONS OF COAL PER YEAR (2000 LBS)
B.T.U PER POUND OF COAL
PER-CENT EFFICIENCY
B.T.U PER H.P HOUR
POUNDS PER H.P HOUR
TONS PER H.P YEAR
PER CENT LOAD FACTOR - PER CENT EFFICIENCY - TONS (2000 LBS) PER H.P YEAR
TONS (2000 LBS) PER YEAR ÷ 1000 - B.T.U PER POUND OF COAL ÷ 1000 - H.P.H PER 100 000 B.T.U ÷ 5 - B.T.U PER H.P HOUR ÷ 2000 - POUNDS PER H.P HOUR ÷ 5
STATION CAPACITY H.P.÷1000

AMOUNT AND EFFICIENCY OF COAL CONSUMPTION IN CENTRAL ELECTRIC STATIONS.

rates of coal consumption for various sizes of stations are as shown below:

Station Capacity K. W.	Rate of Coal Consumption Tons per H.P.Y.
Over 100,000	6.25
50,000 to 100,000	6.57
10,000 to 50,000	9.32
5,000 to 10,000	13.30
1,000 to 5,000	14.00
Under 1,000	25.10 and higher

Now, although it is true that, under very favorable conditions and in plants of the largest sizes, the rate of coal consumption may be as low as 6.25 tons per h.p. year, it is equally correct to state that, taking average existing conditions for electric generating stations in Canada, the rate approximates to 23 tons per h.p. year.

Several of the relations are shown by curves in the illustration, reproduced from the report. One interesting feature noticed is that the curve of coal consumption per h.p. year becomes practically horizontal at a station capacity of about 150,000 h.p., showing that with present equipment, methods of operation, load factors, etc., in the large generating stations, the rate of coal consumption cannot come below about 6.25 tons per h.p. year, no matter how large a station may be. Since the equipment now in use is getting near to the maximum possible efficiency this means that probably under no circumstances will it be possible to get below, say 5.5 tons per h.p. year. Centralization on a vast scale may tend to reduce costs but cannot conserve coal very much as compared with existing conditions in the large stations. At the same time it must be remembered that as the coal bill in a central station usually forms from 40 per cent to 60 per cent of the total costs, even comparatively small percentage savings on this item give high totals in money.

Another point to be observed from the curves is that, comparing stations of say 50,000 h.p. and 200,000 h.p. capacity respectively, it is found that the rates of coal consumption are 8.6 and 6.26 tons per h.p. year, showing a saving of approximately 25 per cent for the larger station. The respective load factors are, however, 36.2 per cent and 44.7 per cent respectively, and there is no doubt that if the smaller stations were operated at the same load factor as that obtained in the larger station the difference in the rates of coal consumption would be much smaller than that given above (excluding other disturbing factors such as the use of poor coal), and emphasizes the fact that the very large stations do not tend to make very big reductions in rates of coal consumption as compared with those of more moderate size.

It is evident from these considerations that coal can be better conserved by appreciably increasing the load factors of existing stations of moderate size (around 50,000 k.w. capacity) than by building huge stations having only slightly higher load factors than those of the smaller sizes.

FLORIDA LIGHTING AND POWER STATIONS.

Preliminary figures of the forthcoming quinquennial report on the central electric light and power stations of the State of Florida have been given out by the Bureau of the Census, Department of Commerce.

The statistics relate to the years ending December 31, 1917, 1912, and 1907, and cover both commercial and municipal plants. They do not, however, cover electric plants operated by factories, hotels, etc., which generate current for their own consumption, those operated by the Federal Government and State institutions, and those that were idle or in course of construction.

The figures presented for Florida show that the increases from 1907 to 1912 have continued during the later five-year period. There was a remarkable increase of 40 in the number of new establishments in the State since 1912, 28 commercial and 12 municipal, although, by reason of the combinations in single reports of a number of plants that reported separately in 1912, there was a net gain of only 32 in number of stations from 1912 to 1917. The total income in 1917 was $2,376,908, almost wholly for electric service, representing a gain of 74.6 per cent since 1912, while the total expenses were $1,684,569, an increase of 60 per cent. The corresponding increases from 1907 to 1912 were 108.1 and 119 per cent, respectively. In 1917 the total horsepower, of which 86.7 per cent was steam, was 58,195, a gain of 72 per cent since 1912. During the same period the kilowatt capacity of the dynamos increased from 23,619 to 37,812, or 60.1 per cent. The output of stations in 1917 was 50,887,992 kilowatt hours, compared with 25,895,751 in 1912, and the relative gains for the two five-year periods were 96.5 per cent and 120.1 per cent, respectively. From 1912 to 1917 there was a slight increase (3 per cent) in the number of arc street lamps, compared with 165.6 per cent for the incandescent and other varieties.

WATER WORKS OPERATION: MAKING WATER ANALYSES*

Information Concerning Nearly One Hundred Water Works Laboratories—Locating Laboratory—Taking Samples.

In October, 1917, J. J. Hinman read a paper before the American Waterworks Association in which he gave the result of an investigation of waterworks laboratories made by him. The investigation was confined to cities of more than 25,000 population, and replies were received from 91 such cities in the United States. Seventy of the plants in these cities were municipal and 21 were private water companies. Thirty-four of them reported an average daily consumption of 5,000,000 gallons or less, the others being larger than this. Nine of the cities obtained their water supply from wells or other underground sources, the remainder from rivers, lakes or surface supplies. Twenty-five did not filter the water, but most of these used chlorine, the total number using chlorine being 70. Most of the laboratories were one-man plants, although in the total 91 plants there were nearly 200 workers classified as chemists, bacteriologists and helpers. Five of the plants had two chemists and five had three each. One plant had two bacteriologists and one had three; twenty plants had one helper, five had two helpers, one had three and one had four. In most cases the chief of the laboratory had the title of chemist or superintendent of filtration. A number of those in charge were engineers who had picked up the rudiments of water examination sufficiently to enable them to carry on routine determinations. The oldest plants were those of New York and Utica, established in 1897. By 1905 the number had increased to ten, and additional ones have been installed each year since then. In addition to the cities reporting special waterworks laboratories, twelve purification plants have daily examinations made at private laboratories or at laboratories in adjacent cities. Thirty-two of these 91 report making plankton examinations, a considerable percentage of the remainder not storing their supplies in reservoirs and therefore having no occasion for such examinations.

* Continued from page 132.

Among the items of interest learned by Mr. Hinman concerning these several plants is the fact that 45 of the cities measured the water supply by Venturi meters, 6 by pitometers and 15 by revolution counters; 26 making no statement as to how the measurement was made, the presumption being that there was no regular method. While measuring water is not directly to be classed as a form of analysis or a laboratory function, such measurement is desirable and even essential where the water is treated with chemicals in order that the amount of chemicals used may be properly proportioned to the amount of water being treated.

A waterworks laboratory should be located close to the point where the samples are taken in routine practice, since many determinations are affected by time, the jarring due to traveling, temperature, etc. Such laboratory need not occupy very much space, but should be well lighted. Ventilation should be provided, and it should be possible to keep the room at a uniform temperature. The walls and ceiling should be plastered or tiled or covered with some other smooth, hard surface that will not collect dust and that does not contain cracks or seams where dust may collect and occasionally be jarred out into the air of the room. Running water, both hot and cold, should be provided. The floor and walls of the room should be solid and so located with reference to machinery or any other distributing factor that there will be no jarring or trembling which would affect the use of delicate balances and other appliances. While larger space is desirable, excellent work has been done in laboratories only five or six feet wide and eight to twelve feet long, with a door in one end and the working table along one side. Double these dimensions will ordinarily be sufficient for any laboratory connected with a small plant and used for water analyses only. Where tests of cement or other solids are to be made, all of the apparatus should be in another room, both because of the space occupied and also to prevent the dissemination of cement and other foreign matters in the air of the laboratory.

Where there are analyses to be made on samples taken from a number of points, such as several reservoirs scattered over a considerable area, it would be convenient to have a laboratory equipment carried in a special body mounted on an automobile chassis, so that the tests can be made, or at least the bacteriological tests begun, as soon as and at the spot where the sample was taken. Such a traveling laboratory, but one more elaborate than would be necessary for most water companies, was used by the New Jersey State Health Department in 1918 and was described in Municipal Journal for May 24th of that year.

Where samples of water are sent out of town for testing, it is desirable to have special containers for shipping them by express. One of the best of these contains a cradle slung in gimbals, which in turn are contained in a stout wooden box reinforced with metal straps; this making it impossible to tip the bottle appreciably from the vertical no matter what position the box should be placed in. The cradle itself is so provided with springs, felt, etc., that even the shock of dropping the box is to a large extent absorbed before reaching the bottle.

Before taking the sample, the bottle should be sterilized, and should be filled and emptied once or twice with the water being sampled before the final sample is taken. The stopper also should be sterilized and rinsed in the water and should be placed in the bottle while both are under the surface of the water or while the water is flowing over them, if this is practicable.

For taking samples at different depths, as in a reservoir, a number of devices have been used in different cities. The general scheme common to most is that of lowering the bottle to the depth where it is desired to take the sample with the cork or stopper in the bottle, then removing the stopper by means of a cord or other device, allowing the bottle to fill and then replacing the stopper and drawing the bottle to the surface. Since the bottle will weigh less than the water when being lowered, it will be necessary to attach a weight at the bottom of it; or the bottle may be fastened to a rod and thus lowered into the water.

DAYTONA SEWERS AND WATER WORKS.

In his report for the year 1918, the superintendent of the Water and Sewerage Department of Daytona, Fla., Geo. A. Main, informs the commissioners that its low water rates have not been increased because of higher costs of materials and labor; in spite of which the department furnished to other city departments "$3,015 more value in service than it has received from other departments, and has, besides, $3,500 more in cash and other assets than at the close of 1917."

Mr. Main recommends a practice in connection with the sewerage system which, while not novel, is by no means common. His recommendation is as follows:

"Daytona's municipal waterworks continues to provide the people with the pure, aerated, softened, artesian water for which Daytona has gained an enviable nation-wide reputation. The rates are low, the standard of service high, and the system of charging for the water service and incidental services in agreement with the systems in force in our leading cities. The municipal sewage disposal system sterilizes the sewage with chlorine gas at the central power plant and discharges the disinfected sewage, free from disease carrying properties, into the tidewaters of the Halifax.

"Our eight hundred and fifteen water customers and five hundred and fifty sewerage patrons are practically unanimous in their approval of the high standard of quality of these respective services and the up-to-date methods in the administration of the affairs of the departments.

"There is but one important change to be recommended, the wisdom of which seems obvious. At the present time the entire cost of operating the disposal system (except the small fund resulting from the $10.00 installation fees), is raised by taxation. Greater equity in the apportioning of the cost of operating and maintaining the disposal system could be and should be arrived at by a nominal charge against patrons making use thereof, the charge to be based on some rational scheme, as is done at Brockton, Mass., for example. Clearly, the principle underlying the disposal system service is the same as that embodied in furnishing water, gas, light, and similar service. The early establishment of such sewer service rates for our city is recommended."

NEW YORK SEWAGE SCREENING PLANT.

Since publishing, on February 15th, the description of the Dyckman street, New York, sewage screening plant, we learn that the plant began about that time to operate 16 hours a day, the operating force consisting of two men, each working an eight-hour shift.

Also we are informed that, although 4h.p. motors were originally specified for the plant, 2h.p. motors were actually installed and, on official test, proved ample to meet all operating conditions. Under normal conditions the actual current consumed for operating the screens is 0.7 kilowatts.

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ELECTRIC AND STEAM PUMPING PLANTS.

Actual figures of cost of operating steam and electric pumping plants, for the same water works service and under presumably the same conditions (except for an increase in amount pumped of less than five per cent), as given in the article in this issue describing the Lancaster plant, show a great advantage in the electric plant, and demonstrate the wisdom of the change. Undoubtedly many other water works plants could effect a greater or less saving in operating costs by a similar change.

This does not follow as a matter of course, however. The relative cost of coal and of current in the place in question will be a most important factor in the comparison. Others to be carefully considered are the making of a proper allowance for interest on the cost of the new plant, the scrap or sale value of the steam plant (if it is not retained for stand-by purposes), and the annual depreciation allowance and upkeep cost of the electric as compared with the steam plant. The load factor, also, may play an important part. If the pumps can operate continuously at a uniform rate, discharging directly into a large reservoir, the cost per million gallons pumped by steam would be less than under conditions like those at Lancaster, where most of the consumption is served by a standpipe whose capacity is about one-twentieth of the daily consumption, and the rate of pumping must vary to a certain extent with that of the consumption.

Also, there are other considerations than those of cost. The National Board of Fire Underwriters considers that an electrically operated pumping plant, deriving its power from a distant plant through wires that may be broken, struck by lightning or otherwise damaged, is less reliable than a plant whose power is generated in the same building. And if less reliable for fire protection, it is also less reliable for other purposes for which the water is used. Interruption might also be caused by a strike, coal shortage, or (in the case of a hydro-electric plant) floods, droughts, ice, etc., which might have been avoided had the power been generated by a municipal steam plant.

It is by no means our object to belittle the advantages of electric plants for water works pumping. Under many conditions they are unquestionable. But we wish to warn against the conclusion that therefore a change from steam to electricity is advisable for every plant. The relative advantages and disadvantages for any given plant can be known only by making a careful study of all the conditions affecting the problem, and no change involving such a large expense should be decided upon until such study has been made by a competent expert.

POWER FOR MUNICIPAL LIGHTING PLANTS.

A problem somewhat similar to the above is discussed in another article this week, this being the securing of maximum efficiency in electric light plants. The article in question records the conclusion, from the investigation of a large number of plants, that economy in coal consumption is secured more by a favorable load factor than by increasing output; and that beyond a certain point, increasing output has little effect on fuel economy.

To apply this, a municipal lighting plant can generally reduce the cost of generating current more effectively by increasing its commercial day-time service than by any amount of extension of lighting service. If it is not possible to obtain a fairly uniform load factor, then it may be cheaper to purchase the current from a power plant that has a diversified consumption of its output and therefore less excessive peak loads; and the fact that a municipal plant can, for this reason, purchase current more cheaply than it can produce it is no reflection on the efficiency of the plant operation, but only the result of a fixed law. When, as is generally the case, the private power plant both has a more favorable load factor and also is much larger than it is practicable or even desirable that the municipal plant should be, then no one conversant with such matters would expect the municipal plant to even approach the larger power plant in efficiency.

The above refers to cost of operating steam plants only, and not necessarily to hydro-electric plants. Moreover, there may be advantages in municipal generation of power (such as those suggested in the discussion above of electric and steam pumping plants) that more than offset those of lower cost of current delivered at the switchboard. But the article in question furnishes an answer that should be convincing to those who would claim that failure of municipal ownership is demonstrated by the abandoning of a municipal power plant because it is cheaper to purchase current from a private central plant. Good business judgment would lead to the same change in the case of a privately operated lighting plant under the same general conditions.

LABOR AVAILABLE FOR ROAD WORK.

One of the most complete and important of the committee reports at the convention this week of the American Road Builders' Association was that by Paul D. Sargent, chairman of the Committee on "Sources of Supply of Unskilled Labor for Highway Work." Mr. Sargent sought information from state highway departments, engineers of the larger cities and road building contractors throughout the country. (We expect to publish this paper next week.) His conclusion from the opinions and facts submitted by these various parties is that "there will be a sufficient supply of unskilled labor for highway projects during the coming season, and at wages slightly less than those prevailing during the season of 1918."

This opinion takes into consideration pending legislation, including the proposed bill for preventing immigration. It would seem to indicate, therefore, that there is no need for any city, county or state to curtail any proposed paving program because of fear that labor

will be unobtainable. As to wage rates, these are expected to be less than last year, the average of all estimates being that the decrease will be about 10 per cent. But even so, they are expected to be on the average 75 per cent greater than in 1914.

The idea that labor will be sufficient for any amount of public works likely to be undertaken is apparently entertained also by the U. S. Department of Labor, which is conducting a vigorous campaign for the immediate inauguration of public works of all kinds, its object being to minimize unemployment of labor this year. There seems to be little question that 1920 will see abundance of work under way. The need is for work *now*, and all are urged to begin as soon as possible any public work that is contemplated.

PAVING STATISTICS OF CITIES.*

The following figures show the total amounts of the different kinds of paving needed and proposed in a number of cities in each of the different sections of the country. See the previous issue for the other sections and explanations.

South Atlantic States.

Sheet asphalt construction, 35,000; resurfacing, 94,000, 94,000; repairing, 2,000.

Brick construction, 36,000; resurfacing, 15,000.

Stone block construction, 10,000, 10,000.

Wood block construction, 20,000, 20,000; repairs, 20,000, 20,000.

Bituminous concrete construction, 66,000, 25,100; repairs, 9,000, 300.

Bituminous macadam construction, 28,000; resurfacing, 4,000; repairs, 13,000.

Waterbound macadam construction, 2,800, 700; repairs, 1,200, 1,200.

Gravel construction, 10,000.

Concrete construction, 32,500, 18,000.

Miscellaneous pavements, 51,000, 48,000.

Gulf States: Alabama, Mississippi, Louisiana and Texas.

Sheet asphalt construction, 9,600, 9,600; resurfacing, 35,000; repairs, 1,500.

Brick construction, 2,725, 2,725; resurfacing, 14,500, 14,500.

Stone block resurfacing, 10,500.

Wood block construction, 3,000, 3,000; repairs, 12,000, 12,000.

Bituminous concrete, 6,000, 6,000.

Bitulithic construction, 259,800, 89,700; resurfacing, 64,500, 64,500; repairs, 3,600, 3,600.

Bituminous macadam repairs, 1,000.

Gravel construction, 175,000, 165,000.

Concrete construction, 194,700, 39,700; repairs, 10,000.

Central States: Ohio, Indiana, Illinois, Kentucky, Tennessee, Arkansas, Missouri, Kansas and Oklahoma.

Sheet asphalt construction, 652,300, 386,150; resurfacing, 227,200, 185,600; repairs, 43,700, 43,150.

Brick construction, 1,637,100, 635,116; resurfacing, 183,200, 119,500; repairs, 43,000, 13,500.

Stone block construction, 119,900, 75,600.

Wood block construction, 121,300, 67,700; repairs, 5,000, 4,600.

Bituminous concrete construction, 356,400, 197,333; resurfacing, 155,000, 85,000; repairs, 79,200, 5,200.

Bitulithic construction, 148,000, 60,000; resurfacing, 25,000; repairs, 10,000.

Bituminous macadam construction, 108,100, 101,800; resurfacing, 67,500, 17,000; repairs, 164,500, 160,000.

Waterbound macadam, 328,500, 265,500; resurfacing, 335,400, 70,000; repairs, 99,200, 64,840.

Gravel construction, 615,500, 115,500; resurfacing, 15,000, 15,000; repairs, 197,200, 128,120.

Concrete construction, 820,100, 511, 750; resurfacing, 24,500, 24,500; repairs, 2,500, 2,000.

Miscellaneous pavements, 148,500.

North Central States: North Dakota, South Dakota, Nebraska, Minnesota, Iowa, Wisconsin and Michigan.

Sheet asphalt construction, 530,700, 313,700; resurfacing, 139,000, 60,000; repairs, 61,700, 44,000.

Brick construction, 238,000, 85,000; resurfacing, 24,700, 3,000; repairs, 3,100.

Stone block construction, 8,100, 8,100.

Wood block construction, 76,600, 28,500; repairs, 3,100, 3,000.

Bituminous concrete construction, 175,000, 63,000; resurfacing, 90,000, 60,000.

Bitulithic construction, 59,000, 20,000; resurfacing, 23,000, 10,000.

Bituminous macadam construction, 25,000, 5,000; resurfacing, 102,400, 82,800; repairs, 10,000.

Waterbound macadam construction, 82,000, 37,000; resurfacing, 47,000, 27,000; repairs, 10,000, 10,000.

Gravel construction, 335,000, 190,000; resurfacing, 243,400, 80,000.

Concrete construction, 454,700, 129,900; resurfacing, 121,000, 121,000.

Miscellaneous pavements, 100,000, 80,000.

Rocky Mountain States: Idaho, Montana, Wyoming, Nevada, Utah, Colorado, Arizona and New Mexico.

Sheet asphalt construction, 289,400, 218,854.

Wood block resurfacing, 5,000, 5,000.

Bituminous concrete construction, 156,100, 95,000.

Bitulithic construction, 352,500.

Gravel construction, 10,000.

Concrete construction, 221,500, 135,000.

Miscellaneous pavements, 25,000.

Pacific States: Washington, Oregon and California.

Sheet asphalt construction, 205,500, 38,830; repairs, 20,200, 5,200.

Brick construction, 214,500, 79,000; resurfacing, 5,000; repairs 300, 300.

Stone block resurfacing, 500.

Wood block construction, 12,860, 12,860; resurfacing, 200.

Bituminous concrete construction, 48,500, 26,000; repairs 900, 700.

Bitulithic construction, 198,400, 112,620; repairs, 1,000, 500.

Bituminous macadam construction, 136,000, 53,000; reconstruction, 27,000, 15,000; repairs, 15,000.

Waterbound macadam construction, 260,000, 181,000; resurfacing, 68,000, 11,000; repairs, 11,000.

Gravel construction, 60,000, 60,000.

Concrete construction, 507,000, 273,900.

Totaling for the entire country (this total, of course, representing only the three hundred cities that have reported to us to date), we obtain the following figures. They should not be accepted as either the total amounts for the United States, or as necessarily proporional to such totals; but as showing the conditions in this number of cities scattered over the entire country. The figures given are for construction and resurfacing combined:

Sheet asphalt needed, 3,351,400; proposed, 2,211,900.

Brick—needed, 3,078,700; proposed, 1,267,200.

Concrete—needed, 2,798,700; proposed, 1,510,700

Gravel—needed, 1,674,500; proposed, 782,100.

Bituminous concrete—needed, 1,444,600; proposed, 775,400.

Bituminous macadam—needed, 1,339,900; proposed 1,110,500.

Waterbound macadam—needed, 1,275,700; proposed, 674,200.

Bitulithic—needed, 1,102,800; proposed, 387,600.

Stone block—needed, 552,500; proposed, 456,800.

Wood block—needed, 308,300; proposed, 193,100.

*Concluded from page 149.

The WEEK'S NEWS

Year's Highway Work in Virginia—Plan to Change Rhode Island's Highway Legislation—Wisconsin Joins U. S. in Venereal Disease Campaign—Reducing Typhoid Toll in California—Successful Municipal Electric Plant in Chicopee, Mass.—Minnesota Forest Fire Victims Aided by State—Propose to Annex Suburbs to Los Angeles—Taxing Railroads in New Jersey—Lower Fares in Buffalo—Higher Fares Refused in Des Moines.

ROADS AND PAVEMENTS

Highway Construction in Virginia.

Richmond, Va.—During the past year, according to the new annual report of G. P. Coleman, state highway commissioner, the state built 294 miles of road, at a cost of $1,038,873.62. This includes small bridges and masonry, with convict labor at $1.12½ a day, but without engineering expenses. The work was divided among 235 different places in 71 counties. Included in the expense is the grading ahead of resurfaced sections over 45 miles. In addition, resurfacing and construction work at a cost of $108,094.29 was done on 50 miles of road. Minor repairs cost $17,883.53. There have been constructed from the joint state and federal fund 13⅛ miles of surfaced road and 2.6 miles of graded road, at a cost of $86,734.18. All the counties in the state except three made application for state aid in 1918 in the form of convict labor or money. Thirty-three counties had convict camps operated in them; and about 900 convicts from the penitentiary and 300 from jails were employed. Joint state and county maintenance has been carried on at a cost of $673,434.30. The "state highway system" cost $11,193.68 for maintenance. Only a small part of this money was available for the past year. In addition to this, approximately 25 miles of road have been constructed with federal appropriations, on account of the damage done by army trucks and the need for military roads in the embarkation sections of the state. During the year 44 bridges were under construction. The cost was estimated at $162,954.42; 34 bridges were completed at a final cost of $135,224.42.

Changes Proposed in Rhode Island Highway Law.

Providence, R. I.—Changes in the highway laws of the state, which will give the state board of public roads the power to determine the width of roads and to acquire private lands for highway purposes, the regulation of motor trucks, and defining state highways, are urgently recommended by the board in its annual report presented to the legislature. The board further points out that never before have the conditions been so desirable for generous appropriations for road work as at the present time, and it asks for an appropriation of at least $400,000 this year in addition to the income from the automobile department for highway construction. The importance of the appropriation being made early in the session is also emphasized. The report contains the first full year's operations of the automobile department under the calendar year form of registration and the increase of more than $39,000 in revenue under adverse conditions, the report states, is a remarkable showing and fully justifies this change in the law. The board reviews the many obstacles which it has had to overcome during the past year due to the war, increased commercial and federal restrictions in road building, and states that under the circumstances the results have been very satisfactory. The policy of the board the past year, the report states, has been to continue as rapidly as possible the work of reconstruction of the main trunk lines where the roadbeds were soft and bad for travel in preference to making roads smooth for high-speed traffic. A strenuous and successful endeavor was made to maintain the good roads, the neglect of which would have been a serious economic error, the report says. Innovations in the types of construction of roads were adopted during the past year, including cement concrete and bituminous concrete, and the board expects much improvement in this line of work. Attention is also called to the failure of the towns and cities to remove snow and ice from the highways, which the law requires them to do, and suggests that some remedy be afforded. No convict labor was used on the highways last year, the board states, but intimates that this is no reason that there will not be in the future. The Penal Commission did not offer any convict labor to the board the past year. The division of road expenditures in 1918 follows: Reconstruction, $397,132.38; repairs to waterbound macadam roads, $108,931,69; repairs to bituminous macadam roads, $24,163.02; oiling waterbound macadam roads, $26,249.04; drainage, widening, cutting brush, guard rails, miscellaneous, $40,667.42; engineering and office expense, $39,875.01; machinery, tools, equipment, $14,650.91; advertisments, $970.62; total, $652,640.09. This total expenditure for reconstruction includes an expenditure of $69,994.26 under the provisions of the Federal Aid Road act. The report of the automobile department shows that there were 1085 accidents during the year. Seventy-one of the accidents resulted in the death of 75 persons; 771 persons were injured in 647 accidents, and 367 accidents resulted in property damage only. There were 1522 court room convictions during the year, resulting in fines of $20,482, and 312 cases were appealed. A total of 39,596 licenses were granted during the year.

SEWERAGE AND SANITATION

$100,000 for Wisconsin Venereal Disease Fight.

Madison, Wis.—Fifty thousand dollars a year for two years to eradicate vice and its diseases is the aim of the Wisconsin health board. It has been assured of co-operation by federal health authorities and awaits sanction of the legislature to make its plans effective. Dr. Ira F. Thompson, acting assistant surgeon of the U. S. Public Health Service, awaits discharge from federal duties to direct the work against social diseases in Wisconsin. The government will give the state $25,000 if the legislature appropriates a similar amount. Present plans are only for one year but a similar campaign is intended the second year. Of the government fund, 10 per cent will be spent in administering the work, 50 per cent in treatment by means of free and pay clinics, buying of remedies and remuneration to physicians and nurses for administering the remedies, 20 per cent in repressive measures such as prosecutions and investigations, and 20 per cent in education measures such as free lectures and distribution of literature. Much of the state fund will go into administrative channels. Capt. E. R. Beckwith, U. S. A., is in Madison to assist in acquainting lawmakers and health administrators with the government's plans.

Typhoid Rate Reduction in California.

Sacramento, Cal.—Since 1915 the typhoid death rate in California has been reduced 50 per cent. and a loss to the state in vital capital, estimated at $1,400,000, has been avoided, according to the report of the sanitary engineering bureau included in the biennial report of the California State Board of Health. The report says: "The net

24,500, 24,500; repairs, 2,500, 2,000.

*Concluded from page 149.

Bricklime—needed, 1,102,800; proposed, 387,600.
Stone block—needed, 552,500; proposed, 456,800.
Wood block—needed, 308,300; proposed, 193,100.

result of all the effort at typhoid control has been to reduce the typhoid death rate per hundred thousand in California from 13.6 in 1914, the year before the bureau was created, to 9.7 in 1915; 7.1 in 1916, 7.4 in 1917, and indications are that a rate of 6.8 will be accomplished in 1918. California is now near the lowest of the states in typhoid death rate and yet there is still a vital loss to the commonwealth by this disease costing over $1,050,000 a year, which can be reduced only by measures for improved water supplies, sewerage and sewage disposal, cleaner streams, cleaner milk, vaccination and the general correction of filth conditions. More than half the urban population of the state, or 1,200,000 persons, are supplied with water from sources equipped with disinfection works, the bureau reported, forty-five cities and towns having installed such works on recommendation of the state bureau. Now 700 water supplies and sewage systems and 300 swimming pools are under regulation of the bureau. "The bureau insists on far-sighted planning," said C. C. Gillespie, director. "One finds 'septic tanks,' representing hundreds of thousands of dollars, in wide use in California. Yet at the time they were built experienced sanitary engineers knew the septic tank by itself was only the preliminary stage in sewage treatment. Notwithstanding this there is scarcely a septic tank of hundreds in California that is designed to fit into a logical enlargement of the plan." The bureau reported progress in summer resort sanitation, regulation of oyster beds to prevent the taking of oysters from polluted waters and inspection of ice.

STREET LIGHTING AND POWER

Municipal Plant Does Well.

Chicopee, Mass.—The charge for electricity for street lights during the coming year will be reduced from 4¼ cents per kilowatt-hour to four cents, according to an announcement made in the annual report of the municipal light commission, filed with mayor D. J. Coakley. At this new rate the street lighting will cost the city about $17,500. This amount may be increased by a number of additional lights being installed. The cost of street lighting during the past year was $18,697.13. The past year, according to the report, was an exceptionally good one for the department and it is not anticipated that the coming year will be as good, as a falling off in the consumption of electricity for power and light is expected. The deficit of the commission has been reduced by $17,663.77 and the indebtedness had been retired by $13,250. The commission sold three turbo-generators and condensers, a motor-driven exciter, a steam-driven exciter, six switchboard panels and the connecting piping and wiring during the year for $42,500. This money has been placed at interest through the city treasurer. It is purposed to use it at the rate of $2,500 a year to pay off the fourth issue of bonds, amounting to $96,000 which were issued to buy, among other things, the equipment which was sold.

Commission Says City Has No Power to Fix Rates.

Alliance, O.—The state public utilities commission has announced its decision in the case of the Alliance Gas & Power Co. It values the property of the company at $621,077 as of May 1, 1918, and allows the company an earning of 8 per cent and depreciation of 5 per cent. The rates are fixed for a period of ten years at 12½ cents and 5 cents for the first two and one-half years and 10½ cents and 5 cents for the last seven and one-half years of the time. The commission declares that the city council had no right to fix power rates and advises it to reopen dealings with the company concerning a fair street-lighting contract. For a number of years the company had been serving residence customers at a rate of 12½ cents per kilowatt-hour for the first thirty hours' use of the maximum demand figured on a basis of 40 per cent of the connected load and 5 cents per kilowatt-hour for all additional energy. In 1916, the city council passed an ordinance fixing the price of energy at 6 cents per kilowatt-hour for the first thirty hours' use and 3 cents for all additional. The company attempted to compromise with the city on a rate of 9 cents for the first thirty hours' use and 5 cents for all additional, but was not successful.

FIRE AND POLICE

Fire Exit Law for Factories Upheld.

New York, N. Y.—The constitutionality of the so-called factory exit law passed by the state legislature after the fatal Triangle fire in 1911, under which every factory building over two stories high must be provided on each floor with at least two means of exit or escape from fire, remote from each other, and all interior staircases must be inclosed by fire-resisting partitions, has been upheld by the Appellate Division of the Supreme Court. The question was decided in a suit of the owners of the Cockroft building against the State Industrial Commission, because structural changes in the building ordered by the commission would mean a loss of $215,928 to the owners. The building is occupied almost solely by manufacturing jewelers, diamond setters, lapidaries, and opticians. The Appellate Division affirmed the ruling of the lower court on the opinion of Justice Gavegan, who tried the case. Justice Gavegan's decision set forth the circumstances under which the law was passed, and stated that the plaintiff had failed to convince him that the building was safe for manufacturing purposes. In considering the constitutionality of the law, Justice Gavegan ruled that it is necessary for the safety of workers in factory buildings, and that the orders involving the Cockroft building are necessary to carry out the spirit of the law.

Fire Service "Wrecking Truck" Valuable.

Boston, Mass.—The emergency wrecking truck of the fire department has rendered very efficient and valuable service since it was installed in fire headquarters about two years ago, according to supervisor of motor apparatus Charles E. Stewart. The machine is a specially built auto truck, equipped with a four-cylinder seventy-horsepower motor, and weighs approximately seven tons. It carries all kinds of wrecking equipment, including jacks, bars, shovels, chains, ropes, repair tools, oil and fifty gallons of gasoline to supply motor pumping engines at fires when needed. The machine can make a speed of from forty to forty-five miles an hour and is equipped with a power winch and derrick on the rear end, which is capable of lifting a weight of ten tons. The wrecker is in reality a traveling repair and machine shop and responds to all third alarms. Among the ordinary uses to which the wrecker can be put are towing in wrecked apparatus, delivering fuel and pulling down walls at fire ruins. It has also been frequently used to rescue horses that had fallen into holes or ditches. The machine has been called to service in several hundred accident cases, and now averages almost a dozen calls a week. The wrecker was designed by supervisor Stewart.

GOVERNMENT AND FINANCE

Commission Declares Los Angeles Annexation Economical.

Los Angeles, Cal.—Annexation to the city of Los Angeles would be an economy to many cities adjoining Los Angeles, the City and County Consolidation Commission has announced in a comparative statement on the tax rate of all municipalities in the county. Los Angeles has a lower tax rate than 20 out of the 37 cities of the county, the City and County Consolidation Commission finds. The joint city, county and state taxes of Los Angeles city are $3.01, which is also the average of the 37 cities compared. If those cities on the border of Los Angeles, which are seeking water, outfall sewers and other metropolitan service were to annex to Los Angeles, it would be possible for them to reduce taxes, as well as to obtain the desired conveniences, in the opinion of the commission. George H.

Dunlop, president of the city and county consolidation commission, who prepared the comparison of tax rates with the assistance of J. S. McQuiston, director of the efficiency commission, and G. Gordon Whitnall of the efficiency bureau has issued the following statement for the benefit of those cities that are considering annexation to Los Angeles:

The City and County Consolidation Commission has had a comparison made of all 1918-19 municipal tax rates in Los Angeles county.

The comparison is made on the combined city and county rates, both based on the uniform county valuation. Of the 37 cities in the county, 20 are shown to have a higher rate than Los Angeles.

Manhattan Beach, with $4.72, has the highest rate in the county. Los Angeles has exactly the average of all cities in the county, $3.01.

That annexation to Los Angeles would be an economy for most cities in the county is shown. Among the larger cities with a rate higher than Los Angeles are:

Santa Monica, $3.98; Redondo Beach, $3.66; Venice, $3.37; Long Beach, $3.36; Glendale, $3.23; South Pasadena, $3.04.

Pasadena shows a rate 6 cents less than Los Angeles, but its municipal rate is based on a valuation above the usual 50 per cent valuation prevailing elsewhere.

Railroads Win Step in Tax Readjustment.

Trenton, N. J.—Supreme court justice Swayze has allowed the Federal Railroad Administration a writ of certiorari to review the action of the State Board of Taxes and Assessment in denying the application of the various railroads of the state for the reduction of the average tax rate of the state. This rate was set at $2.37 per 100; one of the elements entering into the computation being the rate of $1.73 fixed by Jersey City for the month of December. Following the action of the higher court in setting aside the Jersey City rate the railroads asked for a readjustment of the average rate. The railroads of the state have just paid all their taxes which are not affected by this case—about $5,500,000.

TRAFFIC AND TRANSPORATION

Fares Lowered by Commission.

Buffalo, N. Y.—The state public service commission for the second district has ordered the receiver of the Buffalo & Lake Erie Traction Company, beginning on Feb. 6 to charge only 5 cents, with transfer, in the city of Buffalo on all cars where he is now charging 13 cents without a transfer. He must also reduce to 10 cents the fare between the city of Lackawanna and the city of Buffalo on such cars as he is now charging passengers 14 cents, and to restore the sale in the city of Lackawanna of strips of seven tickets for 25 cents which he discontinued in January last and charged 5 cents fare.

Higher Fare Plea Rejected.

Des Moines, Ia.—The application of the receivers for the Des Moines City Railway for a higher fare has been denied by Judge Martin J. Wade in the Federal Court. The decision is considered a victory for the city by the city's attorneys. The company will not appeal. The ruling states that if the company's earnings are not sufficient to meet the fixed charges provided for in the franchise and pay for the present service the service must be adjusted to the income. Immediately upon receipt of the ruling officials of the Des Moines City Railway announced that a general curtailment of service would go into effect. Owl cars are to be abandoned, lines now on a seven-minute service are to be reduced to ten-minute service and non-productive lines are to be further reduced as to service. There is to be no curtailment of rush-hour service according to the announcement. Judge Wade holds that the franchise is a contract and that the fares fixed therein are definite and binding and that they cannot be increased. In this connection Judge Wade rules that the terms of the franchise as regards service are as binding upon the people as upon the company. The court said in part:

The only question involved before the court is whether or not section 17 of the franchise, fixing the fares at six for a quarter, is to be construed with section 7, which provides for the payment from the fares of all costs of operation, including taxes and interest, at not to exceed 5 per cent on the company's indebtedness represented by bond, and not to exceed 6 per cent on the remainder of such indebtedness and the setting aside of a depreciation fund.

It is the contention of the receivers, and for the purpose of this hearing only the contention is assumed to be true, that the income from fares will not pay the cost of operation, taxes, interest and depreciation and continue the present service.

It is here apparent, of course, that if this contention is true, fares will have to be increased or service reduced.

The court cannot close its eyes to the fact that in controversies over franchises for street railway companies, the thing most important in the minds of the people is the rates of fares. Fares touch the people most directly and I have no doubt from all the evidence before the court that so far as the people of Des Moines are concerned they assumed that the fare was definitely and finally determined by this franchise.

Of course the people of Des Moines cannot have service which will not be paid for out of the fares. The receivers are claiming that the service demanded by the city of Des Moines cannot under present changed conditions be rendered from the present income. If this claim is true, of course, it is most unfortunate; and yet these parties have made a contract and the court cannot modify its provisions.

That the contract did not contemplate a change of fares is further emphasized by the omission from the contract of any method of fixing higher fares.

New conditions may render it absolutely impossible for the people to get under the contract, what they expect in the way of service, but the people are bound by the contract as well as the company, and when they get that service which can be paid for under the provisions of the contract, they must be content.

LEGAL NOTES

A Summary and Notes of Recent Decisions—Rulings of Interest to Municipalities

Validity of City Contract—Knowledge of Council.

(W.Va.) Where a city has power to contract by express contract, and a contract is not against public policy, nor statutory or charter provisions, as to the mode of execution, it is liable on an implied contract, where with the knowledge of the council it received benefits rendered at request of duly authorized agents, either in absence of any contract, or where the express contract is invalid for irregularities.—Cade v. City of Bellington, 96 S. E. 1053.

Street Assessments—Judicial Status of Council.

(Ind.App.) Action of common council in levying street improvement assessments is quasi judicial, but the council is not even an inferior court, and so cannot exercise judicial power, and its decision may be collaterally attacked by a property owner in an action to enjoin collection.—Buckingham v. Kerr, 120 N. E. 422.

(Ind.App.) Under Burns' Ann. St. 1914, section 8710 et seq., in determining portion of primary assessment on abutting property of cost of paving improvement which should be carried back to each adjoining tract, common council acts quasi judicially, but in levying other assessments it acts ministerially.—Buckingham v. Kerr, 120 N. E. 422.

Validity of Franchise for Water and Light Company.

(U.S.C.C.A.Tenn.) A contract by a city for the supplying of water and electric lights for public purposes for 30 years, and fixing prices therefor, made under express legislative authority, with a company to which it granted an exclusive franchise for a like term, held valid and enforceable, so far, at least, as it relates to the city's contract, in its proprietary capacity, for a public supply of water and light.—City of La Follette v. La Follette Water, Light & Telephone Co., 252 F. 762.

An ordinance contracting for water and electric lights for public purposes, and incidentally granting to the company furnishing the same an exclusive franchise therefor, which was within the franchise power of the city, and also granting an exclusive franchise to use the streets for supplying water and lights to the inhabitants, which was not within its powers, is divisible and valid at least as to the feature relating to the supplying of water and electric lights for public purposes.—Id.

NEWS OF THE SOCIETIES

March 12.—VERMONT SOCIETY OF ENGINEERS. Annual meeting, Burlington, Vt. Secretary, Geo. A. Reed.

March 25, 26.—AMERICAN WATER WORKS ASSOCIATION, ILLINOIS SECTION. Eleventh annual meeting, Urbana, Ill. Secretary, G. C. Habermeyer, acting chief, State Water Survey, Urbana.

April 14-19.—UNITED STATES GOOD ROADS ASSOCIATION. Annual convention, Mineral Wells, Tex. Secretary, F. A. Rountree, Birmingham, Ala.

April 25-26.—AMERICAN ACADEMY OF POLITICAL AND SOCIAL SCIENCE, Annual meeting, Philadelphia, Pa. Secretary, J. P. Lichtenberger, Logan Hall, West Philadelphia, Pa.

Nov. 12-14, 1919.—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention, New Orleans, La. Secretary, Charles C. Brown, Bloomington, Ill.

Town-Planning Institute of Canada.

At the recent annual meeting of the Association of Dominion Land Surveyors, at Ottawa, the formation of a Town-Planning Institute was announced.

The idea was first formulated at the last annual meeting of the association, when a committee was appointed to form such an institute. The members of the committee were J. D. Craig, W. H. Norrish, F. J. Wight and H. L. Seymour (chairman), all of whom are also members of the topographical surveys committee of the association.

The committee decided that the most pressing phase of town-planning work is lack of education in the movement, so a meeting was arranged with Thomas Adams and Noulan Cauchon and with the three members of the D. L. S. Board of Examiners, namely, Dr. E. Deville, Dr. O. Klotz and M. Tobey. The committee then decided that town-planning had assumed sufficient importance to warrant the formation of a town-planning institute.

Mr. Adams addressed the association, stating that the main object of the institute would be "the promotion of scientific and artistic town-planning both in town and country. The three professions that are primarily interested are architects, engineers and surveyors," said Adams. "The Town-Planning Institute will bring together the members of these three classes in one united group. To form an institute without a sufficient number of men presented a difficulty to those who have been considering the problem. It has been decided that the institute for the first year will consist of probationary members only, each of whom will undertake to prepare a special thesis or to pass an examination before a board before being qualified for full membership.

"A committee of ways and means, consisting of Dr. Deville, surveyor-general; R. H. Millson, president of the Ottawa Chapter of Architects; and myself, have been appointed to prepare a draft prospectus and to submit a list of prospective members to an early meeting. Local branches will be formed in the larger cities, one in Ottawa having already been formed.

"It is desirous to have legal and non-professional members, so the institute will be divided into three groups—

"First, members and associate members (architects, engineers and surveyors); second, legal members; and third, honorary members and associates (non-professional class).

"I believe that the time will come in Canada when our public authorities will appoint engineers to study engineering problems, architects as members of committees for choosing sites, and surveyors will be considered fit to sit on land settlement boards."

In conclusion, Mr. Adams drew attention to the progress made by the British Institute, formed in 1909, and exhibited a series of slides.

New Jersey State County Engineers' Association.

The New Jersey State County Engineers' Association meeting was held at the Engineers' Club, at Trenton, on January 21. The association approved of state aid specifications to be recommended to the state highway commission. These specifications were the result of a year's study and research by members of the association. The report of the sign committee was received, approved and recommended to the state highway commission. The standard road signs and precautionary signs adopted by the association were the result of a year and one-half's work by the committee of the association.

The following officers were elected for the ensuing year: Garwood Ferguson, County Engineer of Passaic County, president; Thomas J. Wasser, County Engineer of Hudson County, vice-president; Alex H. Nelson, County Engineer of Atlantic County, secretary; Alvin B. Fox, County Engineer of Middlesex County, treasurer.

The banquet of the association was held at the Hotel Miller, with William Dill, state commissioner of motor vehicles; W. G. Thompson, state highway engineer; Robert E. Meeker, former state highway engineer, and executive engineers of the association as guests. Commissioner Dill praised the work of the county engineers' association in aiding him in preparing the present motor-truck license regulations. Mr. Thompson spoke of the co-operation between the county engineers and the highway commission on the state highway system.

PERSONALS

Alvord, John W., of the firm of Alvord & Burdick, Chicago, has resigned his position as chief engineer and member of the board of directors of the United States Housing Corporation of the Department of Labor at Washington, and will return to his engineering practice in Chicago. Mr. Alvord has devoted nearly a year of service in organizing the Engineering Division of the Housing Corporation and serving on its board of directors for war emergency work.

Artingstall, William, has resigned his position as project engineer of the United States Housing Corporation, and has resumed the practice as designer and consulting civil engineer, specializing in water supply, sewerage and sewage disposal. His office is in the Old Colony Building, Chicago, Ill.

Berolzheimer, Philip, has been appointed city chamberlain of New York City, succeeding Alfred J. Johnson. Mr. Berolzheimer has served as commissioner of parks for Manhattan and the Bronx and as president of the park board, and is succeeded in these positions by Francis Dawson Gallatin.

Brown, Charles Carroll, has been appointed assistant maintenance engineer in the division of highways, Department of Public Works and Building, state of Illinois. He succeeds Frank T. Sheets, who becomes bridge engineer. Mr. Brown is secretary of the American Society for Municipal Improvements.

Hayes, H. P., has been reappointed county engineer of Tarrant county, Fort Worth, Tex., for a term of two years.

Hopson, William A., Paterson, N. J., has been appointed to the Passaic Valley Sewerage commission to succeed James A. Blauvelt.

Lennon, James T., former mayor of Yonkers, N. Y., died Feb. 6, within an hour after being run over by an automobile. Mr. Lennon was 49 years old and a well-known political leader in the county. He had served four successive terms as mayor of his city, from 1910 until Dec. 31, 1918. Previous to that he was receiver of taxes and then controller.

Monroe, John H., is new fire chief of Savannah, Ga.

Rice, William Gorham, has been reappointed civil service commissioner of New York State for a term of six years.

Sauer, Fred J., assistant engineer in the office of Metcalf & Eddy, consulting engineers, Boston, Mass., died Jan. 30. He had been connected with Metcalf & Eddy for about 1½ years.

Williams, F. M., who served for several terms as mayor of Iowa City, Ia., died recently.

Wingfield, Nisbet, has severed his connection as city engineer and commissioner of public works of Augusta, Ga., and has opened an office as consulting engineer in that city.

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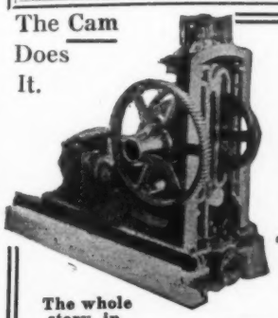

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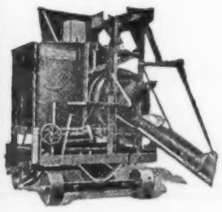
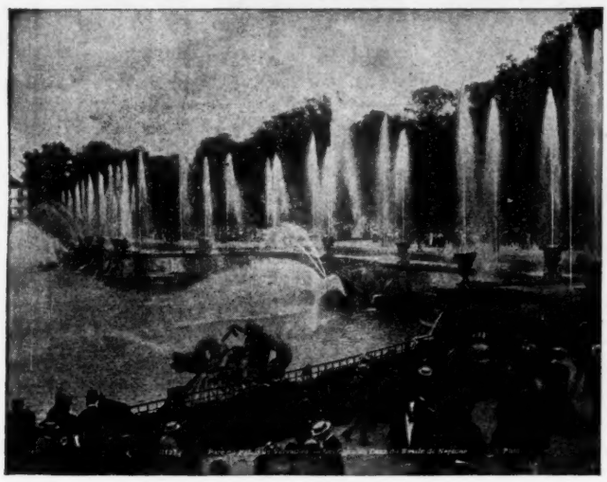


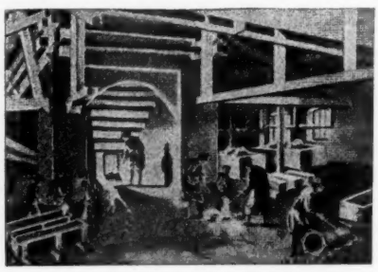
Cast Iron Pipe



"LES GRANDES EAUX," VERSAILLES, FRANCE.

233 Years in Service

THE manufacture and use of Cast Iron Pipe began in France early in the 17th century. According to the Ministry of Public Instruction and Art, all the pipe used for supplying this beautiful park and its fountains with water are of cast iron—installed prior to the opening of the park in 1685.



17TH CENTURY PIPE FOUNDRY IM FRANCE.

The most important of these conduits comprise five lines of 20" pipe, each about two miles long; two lines of 20", each about a mile and a half long; and two lines of 13 1-2", each about one mile long.

All the lines consist of Cast Iron Pipe, made in one meter lengths, joined together with bolted flanges. The only repairs that have been necessary in the lines after 2 1-4 centuries of service is the occasional replacing of rusted out wrought iron bolts. Cast Iron Pipe needs neither argument nor illustration—

But we, all of us, need now and then to be reminded, and this reproduction of a recent photograph of "Les Grandes Eaux," Versailles, France, is, as Kipling says: "Lest we forget."

The Cast Iron Pipe Publicity Bureau

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